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(54) Title: ELECTRICITY MEASURING APPARATUS		
(57) Abstract		
Electricity measuring apparatus (10) in the form of an integral unit (12) comprising a fuse assembly (30) and a meter (32). The unit (12) can be plugged into a conventional fuse base (20) of an electricity supply. The base (20) connects with a neutral connecting member (14) and is engageable with corresponding connections on the unit (12) when the unit (12) is plugged into the base (20).		

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ELECTRICITY MEASURING APPARATUS

This invention concerns electricity measuring apparatus, and particularly but not exclusively apparatus for measuring the electric usage in domestic, industrial or commercial premises.

In domestic premises and industrial or commercial properties it is normal to have the electricity supply metered by a tariff meter which registers energy in kWh. The meter may also measure reactive energy in KVarh. The meter is either single phase or three phase whole current, i.e. the supply current passes directly through the meter, there are no external current transformers.

Between the incoming supply and the meter there is normally put in place circuit protection comprising a fused cut-out. The cut-out consists of a base into which is plugged a carrier with sprung contacts which holds a removable fuse typically rated at 100, 80 or 60 amps. The cut-out serves as the carrier for the fuse and as a means of isolating the supply from the meter and the circuits beyond.

For three phase supplies there will be one fuse per phase which can be in individual carriers or a single composite carrier holding all three fuses. The fuse carriers are provided with means of sealing them in position with an electricity utility seal which consists of a wire passing through holes in the base and carrier so that when the ends of the wire are crimped together with a seal the fuse carrier cannot be removed without breaking the seal.

As an alternative to a fused cut-out it is common to provide circuit protection by a small circuit breaker which can be single or three phase. The circuit breaker is operated automatically by associated current or power detection sensors which detect that pre-set levels of power or current have been exceeded.

According to the present invention there is provided electricity

measuring apparatus, the apparatus comprising a meter for measuring electricity usage and cut-out means, the meter and cut-out means being formed as a single integral unit, which unit is removably connectable to a conventional fuse or circuit breaker base on an incoming electricity supply.

The cut-out means preferably comprises a fuse holder and fuse, and the fuse is preferably selectively removable from the fuse holder.

Alternatively, the cut-out means may comprise a circuit breaker.

The meter is preferably connected in series with the cut-out means, and the meter preferably comprises a current sensor such as a shunt or air cored current transformer, or a power sensor such as a Hall effect device.

The current or power sensor is preferably located in the integral unit, but a sensor could be provided in a base into which the unit is removably connectable.

The meter is preferably connected to the output side of the cut-out means. The meter may monitor the incoming side of the cut-out means to monitor activation of the cut-out.

The apparatus preferably includes a connection to the neutral of the electrical supply, and preferably comprises a member connectable to the neutral supply and which is removably connectable to the integral unit. Said member may be locatable adjacent to a conventional fuse or circuit breaker base on an incoming electricity supply.

The meter preferably comprises a display to indicate electricity consumption. Means may be provided to ensure that the display is the correct way up to be read, and switching means may be provided for inverting or otherwise changing the orientation of the display, and said switching means may be manually operable or automatically operable by gravity sensing means.

The apparatus may comprise an electronic communication port, such as an optical communications port.

The apparatus may include a communications unit which permits data from the meter to be transmitted to local associated equipment and/or to a remote data collection means.

The communication unit may include a radio transmitter, modem, or means for communicating over the power distribution network. The communication unit is preferably part of the integral unit.

The communicating means may be arranged to automatically transmit a signal in the event of activation of the cut-out means.

The apparatus may be arranged for use with a multi-phase supply such as a three phase supply, with a respective meter and cut-out means for each phase. The meters and cut-out means may be provided in a single integral unit. Summing means may be provided for summing the readings for each supply, and a summing means may be located within the integral unit.

An embodiment of the present invention will now be described by way of example only, with reference to the accompanying drawing which is a diagrammatic perspective view of electricity measuring apparatus according to the invention.

The drawings show electricity measuring apparatus 10 in the form of an integral unit 12 and a neutral connecting member 14. The member 14 comprises means to permit connection in a conventional manner to a neutral cable 16. The member 14 also includes low current neutral connections 18 engageable with corresponding connections (not shown) on the unit 12. The member 14 is located next to a conventional fuse base 20 of an electricity supply as provided for domestic, industrial or commercial premises. The base 20 is of conventional configuration with connection to an incoming supply wire

22 which connects with a first socket 24, and a second socket 26 which connects to an outgoing wire 28. Generally the member 14 and base 20 are integral, though they can be separable.

The unit 12 comprises a fuse assembly 30 and an electricity meter 32. The assembly 30 comprises a housing 34 in which a fuse (not shown) is removably locatable with an openable part 36 of the housing permitting access to the fuse.

Alternatively the assembly 30 comprises a housing in which a circuit breaker with its associated power or current sensors are located. Connections are provided from the location of the fuse to conventional sprung contacts 38 which are removably locatable respectively in the sockets 24,26.

In the example of a circuit breaker the integral unit of meter and circuit breaker may be screwed into the supporting base unit.

The meter 32 is an electronic kWh measuring unit with a current sensor which may be a shunt or air cored current transformer. The current sensor is connected in series with the fuse or circuit breaker on the output side thereof. The meter 32 comprises a display 40 which may be of any suitable type and in this instance is an LCD display. The meter 32 comprises an electronic communication port 42 in the form of an optical communication port. The port 42 permits readings to be made by electronic means such as a handheld computer. The port 40 could also be connected to equipment such as a device for payment of electricity or a storage and communications unit to permit remote meter reading and interrogation over a communications medium.

In use, the unit 12 can be plugged into the base 20 in a conventional manner with neutral connections being provided via the connections 18. An appropriate security seal of for example the above described type, could be made between the base 20 and unit 12 to prevent unauthorised tampering. The unit 12 can readily be connected to the base 20 and hence electricity supply

without the requirement for any hard wiring of connections etc. This enables ready removal of the unit 12 and hence electricity meter, for repair, replacement, maintenance etc.

Various modifications may be made to the apparatus without departing from the scope of the invention. For example, whilst the unit is described as being connected to the downstream side of the fuse or circuit breaker it could be connected to the input side or some form of connection made thereto, such that failure of the fuse or operation of the circuit breaker can be recorded and perhaps an appropriate message transmitted. The unit may be arranged such that the display can be in a correct orientation irrespective of the orientation of the unit. Switching means may be provided for inverting the characters on the display and the switching means could be manual or automatic with gravity sensitive means. It may be possible to have a larger display or perhaps a rotatable display such that the display could be in at least a generally correct orientation irrespective of the orientation of the unit. Rather than a current sensor, a power sensor such as a Hall effect device could be used.

A different type of electronic communication port could be provided. Communication means could be provided within the unit. For example a radio transmitter could transmit the meter readings on demand or at regular intervals to other associated equipment local to the meter or to a data collection unit at a remote point. Other possible forms of communication would be a modem for use on telephone or cable networks or a unit for communicating over the power distribution network. With remote meter reading, the display could be for indication purposes only and not tariff purposes.

As noted above the meter may be arranged to monitor a failure in the fuse or operation of a circuit breaker, and the unit could be arranged to automatically send a signal to communicate such failure. Where a conventional fuse base is not used it would be possible for the current sensor to be part of the base. Whilst the above described invention contains a fuse or circuit breaker, other cut-outs could be usable.

Apparatus according to the invention could be used with a multiple phase supply such as a three phase supply, and a respective meter and fuse or circuit breaker would be supplied for each phase. An output of the readings for each meter could be communicated through the port for summing or a summing unit could be provided within the apparatus, to give a total three phase energy reading. The meters and fuses could be provided in a single integral unit, or in a unit for each phase.

The invention provides a number of advantages in addition to those outlined above. For instance the apparatus can readily be interfaced to other equipment such as pre-pay units and communication devices. In the electricity supply industry there is often a division between the network business and the supply business. The responsibility for any special equipment for supply is that of the supply business, and by incorporating the meter with the fuse or circuit breaker the responsibilities are matched by the equipment placement. Apparatus according to the present invention should be more secure against theft which is presently common as a result of tampering with conventional meters and their connections. The present invention permits fuse failure to be detected and an alarm signal sent automatically.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

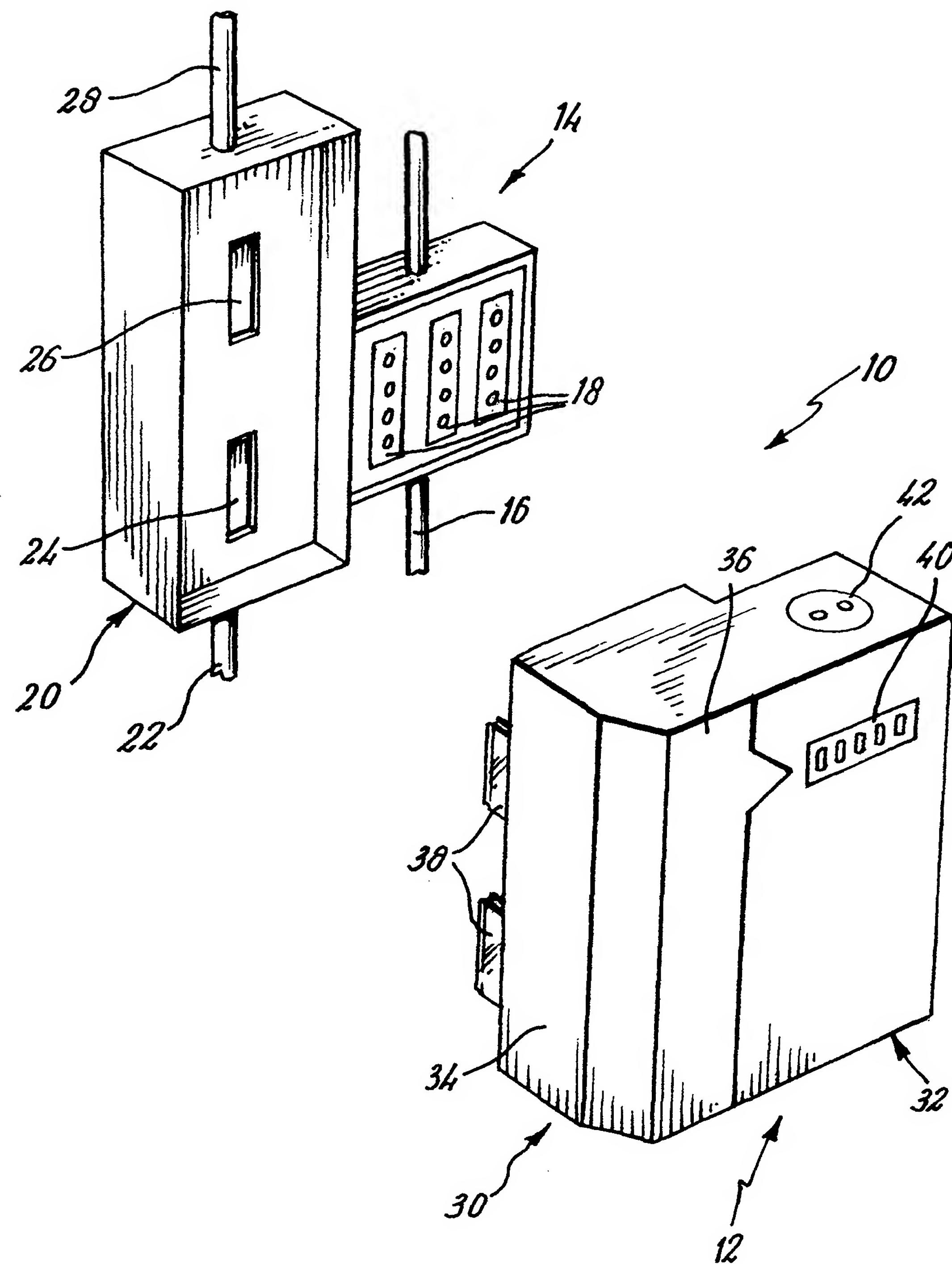
CLAIMS:-

1. Electricity measuring apparatus, the apparatus comprising a meter for measuring electricity usage and cut-out means, the meter and cut-out means being formed as a single integral unit, which unit is removably connectable to a conventional fuse or circuit breaker base on an incoming electricity supply.
2. Apparatus according to claim 1, in which the cut-out means comprises a fuse holder and fuse.
3. Apparatus according to claim 2, in which the fuse is selectively removable from the fuse holder.
4. Apparatus according to claim 1, in which the cut-out means comprises a circuit breaker.
5. Apparatus according to any of the preceding claims, in which the meter is connected in series with the cut-out means.
6. Apparatus according to any of the preceding claims, in which the meter comprises a current sensor.
7. Apparatus according to claim 6, in which the current sensor comprises a shunt.
8. Apparatus according to claim 6, in which the current sensor comprises an air cored current transformer.
9. Apparatus according to any of claims 1 to 5, in which the meter comprises a power sensor.
10. Apparatus according to claim 9, in which the power sensor comprises a Hall effect device.

11. Apparatus according to any of claims 6 to 10, in which the current or power sensor is located in the integral unit.
12. Apparatus according to any of claims 6 to 11, in which the current or power sensor is provided in a base into which the unit is removably connectable.
13. Apparatus according to any of the preceding claims, in which the meter is connected to the output side of the cut-out means.
14. Apparatus according to claim 13, in which the meter monitors the incoming side of the cut-out means to monitor activation of the cut-out.
15. Apparatus according to any of the preceding claims, in which the apparatus includes a connection to the neutral of the electrical supply.
16. Apparatus according to claim 15, in which the apparatus comprises a member connectable to the neutral supply and which is removably connectable to the integral unit.
17. Apparatus according to claim 16, in which said member is locatable adjacent to a conventional fuse or circuit breaker base on an incoming electricity supply.
18. Apparatus according to any of the preceding claims, in which the meter comprises a display to indicate electricity consumption.
19. Apparatus according to claim 18, in which means are provided to ensure that the display is the correct way up to be read.
20. Apparatus according to claim 190, in which switching means may be provided for inverting or otherwise changing the orientation of the display.

21. Apparatus according to claim 20, in which said switching means is manually operable.
22. Apparatus according to claim 20, in which said switching means is automatically operable by gravity sensing means.
23. Apparatus according to any of the preceding claims, in which the apparatus comprises an electronic communication port.
24. Apparatus according to claim 23, in which the apparatus comprises an optical communications port.
25. Apparatus according to any of the preceding claims, in which the apparatus includes a communications unit which permits data from the meter to be transmitted to local associated equipment and/or to a remote data collection means.
26. Apparatus according to claim 25, in which the communication unit includes a radio transmitter.
27. Apparatus according to claim 25, in which the communication unit includes modem.
28. Apparatus according to claim 25, in which the communication unit includes means for communicating over the power distribution network.
29. Apparatus according to any of claims 25 to 28, in which the communication unit is part of the integral unit.
30. Apparatus according to any of claims 25 to 29, in which the communication unit is arranged to automatically transmit a signal in the event of activation of the cut-out means.

31. Apparatus according to any of the preceding claims, in which the apparatus is arranged for use with a multi-phase supply such as a three phase supply, with a respective meter and cut-out means for each phase.
32. Apparatus according to claim 31, in which the meters and cut-out means are provided in a single integral unit.
33. Apparatus according to claims 31 or 32, in which summing means are provided for summing the readings for each supply.
34. Apparatus according to claim 33, in which a summing means is located within the integral unit.



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/03561

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01R22/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^a	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	GB 2 325 747 A (FORREST ANDREW) 2 December 1998 (1998-12-02) claims 1-37; figure 1 ----	1-34
Y	DE 296 03 333 U (MEYER GERHARD DR ING) 18 April 1996 (1996-04-18) the whole document ----	1-4, 6-8, 11, 18, 23-30
Y	WO 98 10299 A (EHRKE LANCE A ; INNOVATEC CORP (US); NAP KIMBEL A (US); DRESSELHUYS) 12 March 1998 (1998-03-12) page 7, line 10 - page 9, line 19; claim 15; figure 3 ---- -/-	1-4, 6-8, 11, 18, 23-30

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 280 960 A (SIEMENS MEASUREMENTS LTD) 15 February 1995 (1995-02-15) page 4, paragraph 4 - paragraph 5 abstract; figure ---	2,3
A	GB 2 187 851 A (ASS ELECT IND) 16 September 1987 (1987-09-16) -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 2325747	A	02-12-1998	NONE		
DE 29603333	U	18-04-1996	NONE		
WO 9810299	A	12-03-1998	EP 0923742 A	23-06-1999	
			WO 9810394 A	12-03-1998	
GB 2280960	A	15-02-1995	GB 2280961 A,B	15-02-1995	
			GB 2280962 A,B	15-02-1995	
GB 2187851	A	16-09-1987	NONE		